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EXAMINER
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JONES, HUGH M

ART UNIT	PAPER NUMBER
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2128

MAIL DATE	DELIVERY MODE
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02/03/2009

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/016,437	<b>Applicant(s)</b> DUTTA ET AL.	
	<b>Examiner</b> Hugh Jones	<b>Art Unit</b> 2128	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 23 October 2008.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-8, 12-15, 17-27 and 29-32 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-8, 12-15, 17-27, 29-32 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                     | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

### **DETAILED ACTION**

1. Claims 1-8, 12-15, 17-27, 29-32 of U. S. Application 10/016,437, filed 12/10/2001, are presented for examination.

#### ***Claim Objections***

2. Claims 12-15, 18-19, 21-22 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. The claims depend upon canceled claims. No assumptions are made about possible claim dependence because other issues such as *lack of antecedent basis* then arise. These claims are therefore not reviewed with respect to prior art.

#### ***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 26-27 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.
5. Applicants refer to par. 33 of the specification as showing support for 'hydrophones'. However, the paragraph only states:

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[0033] The seismic data that is used can either be acquired solely for detection of SWF, or can be seismic data that has been acquired for different modeling purposes, and reprocessed for detection of SWF. The seismic data can be three-dimensional ("3D"), two-dimensional ("2D"), or one-dimensional ("1D") data. For example, borehole 1D data can be used to detect SWF, and full 3D seismic data can be used to detect SWF in a well field. The seismic data can be acquired using any known acquisition technique, such as towing streamers behind a seismic vessel and measuring the reflection of acoustic waves generated by marine sources.

The issue is more than one of semantics because Applicants base many of their arguments upon the alleged difference between hydrophones and geophones, and do so without providing evidence.

**Claim Rejections - 35 USC § 103**

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.

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2. Ascertaining the differences between the prior art and the claims at issue.
  3. Resolving the level of ordinary skill in the pertinent art.
  4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
8. Claims 1-8, 17, 20, 23-27, 29-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mallick (11/2000; "Hybrid seismic inversion: A reconnaissance tool for deepwater exploration") in view of Huffman (**6,694,261**). Claims 12-15, 18-19, 21-22 are not examined.

9 Mallick discloses all limitations, as subsequently discussed, but does not expressly disclose the application of the technique to Shallow Water Flow (SWF).

10. Huffman discloses a method for identification of shallow water flow hazards using seismic data (see title), using the same types of techniques.

11. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the Mallick teaching to include the Huffman teaching because Huffman disclose in the "background of the art" that there is a need to identify SWF prior to drilling a borehole.

12. Specifically, the combination discloses:

1. (Currently Amended)

A method for determining shallow water flow risk

comprising: developing a geologic model of shallow water flow risk areas; performing a stratigraphic analysis on only P-wave seismic data to determine a control location within the P-wave seismic data (M: Page 1230 (col. 2-3): The **elastic earth models (consisting of P-wave velocity, density, and Poisson's ratio)** obtained at each location of the prospect where **prestack GA inversion** was run can be used as background low-frequency impedance trends for poststack inversion and can create a hybrid inversion scheme.); applying a pre-stack full waveform inversion on only the P-wave seismic data at the control location to provide an elastic model, wherein the elastic model comprises pressure-wave velocity and shear-wave velocity (M: Page 1230 (col. 1):

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This hybrid methodology first runs prestack genetic algorithm (GA) inversion at discrete locations over the entire data volume. Detailed elastic models obtained from prestack inversion then constrain background trends for poststack inversion.

Page 1230 (col. 2-3): The **elastic earth models (consisting of *P*-wave velocity, density, and Poisson's ratio)** obtained at each location of the prospect where **prestack GA inversion** was run can be used as background low-frequency impedance trends for poststack inversion and can create a hybrid inversion scheme.

Page 1233: Comparison of Figures 1b and 1c demonstrates the need for fine discretization of the earth models in *prestack inversion*. *Our inversion uses a full wave-equation approach* that takes all primary, mode-converted, and interbed multiple reflections into account. To correctly model all stratigraphic details of the subsurface, inclusion of mode conversions and interbed multiple reflections is necessary. In addition, to correctly model thin-bed tuning effects due to these mode conversions and multiple reflections, it is necessary to discretize the earth model to one-fourth of the dominant wavelength of the input seismic data.

Page 1234: It is also important to note that the full waveform prestack inversion plays a very important role in the hybrid inversion. First of all, it is prestack inversion that provides the low-frequency *P*- and *S*-wave impedance trends for our hybrid inversion. When well data (normally used to define low-frequency impedance trends) are not available, prestack inversion is the only way to obtain this information.

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In addition to providing low-frequency trends, prestack inversion can also verify the validity of the poststack inversion. Poststack inversion assumes that every event on seismic data is a primary reflection. If seismic trace amplitudes are contaminated by interference effects, poststack inversion will be ambiguous. **Prestack inversion, on the other hand, uses a full wave-equation approach** that correctly handles such interference effects.);

computing a ratio between the pressure-wave velocity and the shear-wave velocity; and identifying shallow water flow risk areas using the pressure-wave velocity to the shear-wave velocity ratio.

(M: Page 1230 (col. 2-3): The **elastic earth models (consisting of *P*-wave velocity, density, and Poisson's ratio)** obtained at each location of the prospect where **prestack GA inversion** was run can be used as background low-frequency impedance trends for poststack inversion and can create a hybrid inversion scheme.; H: col. 6, lines 6-54, col. 6; col. 11, line 60 to col. 12, line 49)

Re ratio: Huffman (US 6,694,261) :

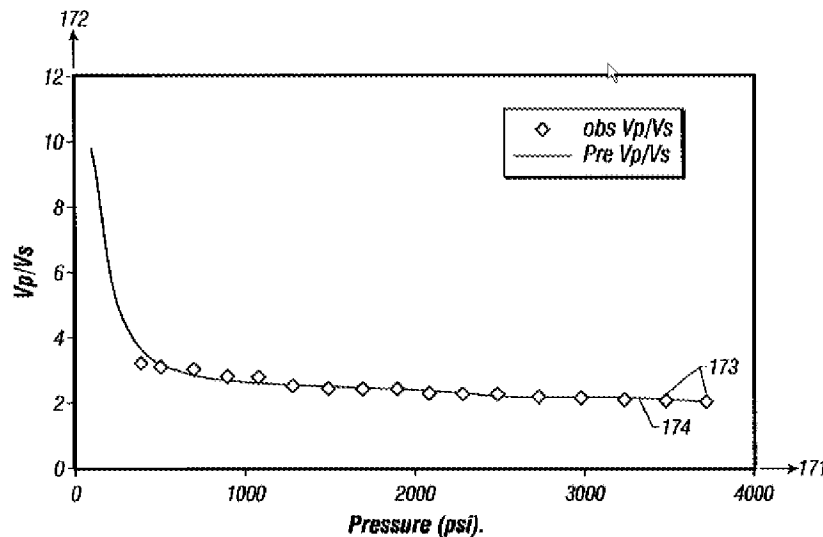


FIG. 3C

It is of particular interest to note that the compressional velocities for the data of FIGS. 3b and 3d the sands shows relatively little dependence upon the effective stress, and at low stresses, is approximately 2000 meters per second. The  $V_p/V_s$  ratio, on the other hand, increases from a value of about 2.5 at 1000 psi to over 6.0 at 20 psi.

An effective stress of 1000 psi corresponds roughly to a subsurface depth of approximately 2000 feet for normally pressured sediments. This is within the range where abnormally pressured SWF sands have been encountered in deepwater drilling. What FIGS. 3a-3d show is that if such a sand is buried and the fluid pressure builds up due to differential compaction or structural geopressuring, there is a small change in the compressional wave velocity and a large change in the shear velocity of the sand. This difference in shear wave velocity will manifest itself as a time delay, or "static" shift in the seismic data that will make the abnormally-pressured SWF sand appear thicker in time on the shear wave data due to the low shear velocities. Additionally, a sand with a shear velocity of 700 to 800 m/s would have a relatively small difference in shear wave impedance with an overlying clay or silt sediments whereas a sand with a shear velocity of 300 m/s or less would have a much larger difference in shear wave impedance with overlying sediments. As would be well known to those versed in the art, such a difference in shear wave impedance should be detectable by suitable seismic methods. What is important for the present invention is that the abnormal pressure in a sand body will produce a small change in compressional velocity and impedance and a large change in shear velocity and impedance; the exact magnitude of the change and the mechanism that causes the change is relatively unimportant.

Col. 6:

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2. (Original) The method of claim 1, wherein the seismic data comprises seismic data selected from the list consisting of one-dimensional seismic data, two-dimensional seismic data, and three-dimensional seismic data (M: fig. 1-2, for example ; H: col. 6, lines 6-54, col. 6; col. 11, line 60 to col. 12, line 49).

3. (Original) The method of claim 1, wherein the elastic model further comprises attributes selected from the list consisting of density, Poisson's ratio, and Lamé elastic parameters.

(M: Page 1230 (col. 2-3): The elastic earth models (consisting of P-wave velocity, density, and Poisson's ratio) obtained at each location of the prospect where prestack GA inversion was run can be used as background low-frequency impedance trends for poststack inversion and can create a hybrid inversion scheme; H: col. 6, lines 6-54, col. 6; col. 11, line 60 to col. 12, line 49; fig. 13)

4. (Original) The method of claim 1, further comprising processing the seismic data to enhance its stratigraphic resolution.

(H: col. 6, lines 6-54, col. 6; col. 11, line 60 to col. 12, line 49; M: pg. 1234, col. 1, for example)

5. (Original) The method of claim 4, wherein the processing the seismic data comprises sub-sampling the seismic data to less than two millisecond intervals.

(H: col. 6, lines 6-54, col. 6; col. 11, line 60 to col. 12, line 49; M: fig. 12)

6. (Original) The method of claim 4, wherein the processing the seismic data comprises using an algorithm with an amplitude preserving flow.

(H: col. 6, lines 6-54, col. 6; col. 11, line 60 to col. 12, line 49); Mallick discloses amplitude preserving techniques in Appendix A. Also see (page 1233): Comparison of Figures 1b and 1c demonstrates the need for fine discretization of the earth models in prestack inversion. Our inversion uses a full wave-equation approach that takes all primary, mode-converted, and interbed multiple reflections into account. To correctly model all stratigraphic details of the subsurface, inclusion of mode conversions and interbed multiple reflections is necessary. In addition, to correctly model thin-bed tuning effects due to these mode conversions and multiple reflections, it is necessary to discretize the earth model to one-fourth of the dominant wavelength of the input seismic data.

7. (Original) The method of claim 4, wherein the processing the seismic data comprises using an algorithm selected from the list consisting of a pre-stack time migration, accurate velocity normal-moveout correction, and noise removal algorithms.



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(M: Page 1233: Comparison of Figures 1b and 1c demonstrates the need for fine discretization of the earth models in prestack inversion. Our inversion uses a full wave-equation approach that takes all primary, mode-converted, and interbed multiple reflections into account. To correctly model all stratigraphic details of the subsurface, inclusion of mode conversions and interbed multiple reflections is necessary. In addition, to correctly model thin-bed tuning effects due to these mode conversions and multiple reflections, it is necessary to discretize the earth model to one-fourth of the dominant wavelength of the input seismic data.

Page 1234: It is also important to note that the full waveform prestack inversion plays a very important role in the hybrid inversion. First of all, it is prestack inversion that provides the low-frequency *P*- and *S*-wave impedance trends for our hybrid inversion. When well data (normally used to define low-frequency impedance trends) are not available, prestack inversion is the only way to obtain this information.; Page 1235: In addition to providing low-frequency trends, prestack inversion can also verify the validity of the poststack inversion. Poststack inversion assumes that every event on seismic data is a primary reflection. If seismic trace amplitudes are contaminated by interference effects, poststack inversion will be ambiguous. **Prestack inversion, on the other hand, uses a full wave-equation approach** that correctly handles such interference effects.); H: col. 6, lines 6-54, col. 6; col. 11, line 60 to col. 12, line 49)

8. The method of claim 1, wherein the control location comprises a plurality of control locations.

(M: Page 1230, col. 1: This hybrid methodology first runs prestack genetic algorithm (GA) inversion at discrete locations over the entire data volume. Detailed elastic models obtained from prestack inversion then constrain background trends for poststack inversion. Page 1230 (col. 2-3): The **elastic earth models (consisting of *P*-wave velocity, density, and Poisson's ratio)** obtained at each location of the prospect where **prestack GA inversion** was run can be used as background low-frequency impedance trends for poststack inversion and can create a hybrid inversion scheme.; H: col. 6, lines 6-54, col. 6; col. 11, line 60 to col. 12, line 49)

12. (Original) The method of claim 11, wherein performing the stratigraphic analysis comprises identifying the control location by using the geologic model to identify a geologic feature selected from this list consisting of faults, blow-outs, bioherms, chaotic facies, cones, diapirs, domes, gas vents, gas mounds, mud volcanoes, popckmarks, scarps, slumps, channels, slope fan deposition, and bottom simulator reflectors. (intended use; M: pg. 1236: If so, they may correspond to shallow gas pockets and can cause significant drilling hazards.; H: col. 6, lines 6-54, col. 6; col. 11, line 60 to col. 12, line 49).

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13. (Original) The method of claim 9, wherein selecting the control location within the seismic data further comprises evaluating the seismic attributes of the seismic data. (M: Page 1230 (col. 1):

This hybrid methodology first runs prestack genetic algorithm (GA) inversion at discrete locations over the entire data volume. Detailed elastic models obtained from prestack inversion then constrain background trends for poststack inversion.

Page 1230 (col. 2-3): The elastic earth models (consisting of *P*-wave velocity, density, and Poisson's ratio) obtained at each location of the prospect where prestack GA inversion was run can be used as background low-frequency impedance trends for poststack inversion and can create a hybrid inversion scheme.

Page 1233: Comparison of Figures 1b and 1c demonstrates the need for fine discretization of the earth models in prestack inversion. Our inversion uses a full wave-equation approach that takes all primary, mode-converted, and interbed multiple reflections into account. To correctly model all stratigraphic details of the subsurface, inclusion of mode conversions and interbed multiple reflections is necessary. In addition, to correctly model thin-bed tuning effects due to these mode conversions and multiple reflections, it is necessary to discretize the earth model to one-fourth of the dominant wavelength of the input seismic data.

Page 1234: It is also important to note that the full waveform prestack inversion plays a very important role in the hybrid inversion. First of all, it is prestack inversion that provides the low-frequency *P*- and *S*-wave impedance trends for our hybrid inversion. When well data (normally used to define low-frequency impedance trends) are not available, prestack inversion is the only way to obtain this information.;

H: col. 6, lines 6-54, col. 6; col. 11, line 60 to col. 12, line 49)

14. (Original) The method of claim 13, wherein evaluating the seismic attributes comprises using amplitude-variation-with-offset attributes, comprising intercept and gradient.

(M: appendix A; ; H: col. 6, lines 6-54, col. 6; col. 11, line 60 to col. 12, line 49)

15. (Previously Presented) The method of claim 13, wherein evaluating the seismic attributes comprises evaluating polarity changes in reflection coefficient.; H: col. 6, lines 6-54, col. 6; col. 11, line 60 to col. 12, line 49)

17. (Original) The method of claim 1, wherein the pre-stack waveform inversion comprises applying a genetic algorithm. (M: Page 1230 (col. 2-3): The elastic earth models (consisting of *P*-wave velocity, density, and Poisson's ratio) obtained at each location of the prospect where prestack GA inversion was run can be used as background low-frequency impedance trends for poststack inversion and can create a hybrid inversion scheme; H: col. 6, lines 6-54, col. 6; col. 11, line 60 to col. 12, line 49)

20. (Currently Amended)

The method of claim 18, wherein applying the pre- stack full waveform inversion comprises using

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an exact wave equation having mode conversions and interbed multiple reflections. (M: pg. 1233 (col. 1-2): Comparison of Figures 1b and 1c demonstrates the need for fine discretization of the earth models in prestack inversion. Our inversion uses a full wave-equation approach that takes all primary, mode-converted, and interbed multiple reflections into account. To correctly model all stratigraphic details of the subsurface, inclusion of mode conversions and interbed multiple reflections is necessary.)

23. (Original) The method of claim 1, further comprising applying a post-stack inversion on the seismic data using the elastic model to determine the shallow water flow risk over a 3D volume. (H: col. 6, lines 6-54, col. 6; col. 11, line 60 to col. 12, line 49).

24. (Original) The method of claim 1, wherein the post-stack inversion is performed using an AVO intercept and a pseudo shear-wave data volume. (M: appendix A; H2: col. 6, lines 6-54, col. 6; col. 11, line 60 to col. 12, line 49).

25. (Original) The method of claim 1, wherein shallow water flow risk is identified when the pressure-wave velocity compared to the shear-wave velocity is between approximately 3.5 and approximately 7. (H: col. 6, lines 6-54, col. 6; col. 11, line 60 to col. 12, line 49)

26. A computerized method for determining shallow water flow risk using seismic data comprising:  
processing the P-wave seismic data to enhance its stratigraphic resolution using towed hydrophones (insignificant post solution data collection which does not affect the method itself – regardless, a skilled artisan would use the towed sensors as needed);  
selecting a control location comprising:  
performing a stratigraphic analysis on the P-wave seismic data (see claim 1); and  
evaluating the seismic attributes of the P wave seismic data (see claim 1);  
applying a pre-stack waveform inversion on the seismic data at a selected control location to provide an elastic model, wherein the elastic model comprises pressure- wave velocity and shear-wave velocity (see claim 1);  
applying a post-stack inversion on the P wave seismic data using the elastic model (see claim 1);  
and to map a ratio between the P-wave velocity and the S-wave velocity in a three dimensional (3D) volume (see claim 1); and  
determining the shallow water flow risk using the ratio between the P-wave velocity and the S-wave velocity in the 3D volume. (H: col. 6, lines 6-54, col. 6; col. 11, line 60 to col. 12, line 49)

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27. (Original) The method of claim 26, wherein the pre-stack waveform inversion comprises using a genetic algorithm comprising:

generating a plurality of elastic earth models;

generating pre-stack synthetic seismograms for the elastic earth models;

matching the generated seismograms with the seismic data;

generating a fitness for the elastic earth models;

genetically reproducing the elastic earth models using the fitness for the elastic earth models; and

determining convergence of the reproduced elastic earth models to select the elastic model.

( ; H: col. 6, lines 6-54, col. 6; col. 11, line 60 to col. 12, line 49).

29. (New) A method for determining a shallow water flow risk area, comprising:

developing a geologic model of the shallow water flow risk area;

performing a stratigraphic analysis on only P-wave seismic data to determine a

control location within the P-wave seismic data;

applying a pre-stack waveform inversion on the P-wave seismic data at the control location to

provide P-wave velocity ( $V_p$ ) and Poisson's ratio;

computing for S-wave velocity ( $V_s$ ) using the P-wave velocity ( $V_p$ ) and the Poisson's ratio;

computing for a ratio between the P-wave velocity ( $V_p$ ) and the S-wave velocity ( $V_s$ ); and

identifying the shallow water flow risk area using the ratio ( $V_p/V_s$ ).

(limitations have already been discussed).

30. (New) The method of claim 29, wherein the S-wave velocity ( $V_s$ ) is computed using

the recited formula. (M: Page 1230 (col. 2-3): The **elastic earth models (consisting of P-wave velocity, density, and Poisson's ratio)** obtained at each location of the prospect where **prestack GA inversion** was run can be used as background low-frequency impedance trends for poststack inversion and can create a hybrid inversion scheme.; H: col. 6, lines 6-54, col. 6; col. 11, line 60 to col. 12, line 49)

31. (New) The method of claim 1, wherein the P-wave seismic data are a single

component P-wave seismic data (doesn't further limit the method; regardless, M: pg. 1233 (col. 1-2): Comparison of Figures 1b and 1c demonstrates the need for fine discretization

of the earth models in prestack inversion. Our inversion uses a full wave-equation approach that takes all primary, mode-converted, and interbed multiple reflections into account. To correctly model all stratigraphic details of the subsurface, inclusion of mode conversions and interbed multiple reflections is necessary.).

32. (New) The method of claim 1, wherein the S-wave velocity is obtained indirectly from an

amplitude variation with offset (AVO) analysis of the P-wave seismic data (M: pp. 1230-1231:

compute  $P$ - and  $S$ -wave impedances from prestack data and use standard AVO processing to generate AVO intercept and AVO gradient volumes. Next, we assume a background  $P$ - to  $S$ -wave velocity ratio,

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and combine the AVO intercept and gradient volumes to generate a pseudo S-wave volume. A derivation for computing pseudo S-wave data from the AVO intercept and gradient is presented in Appendix A; appendix A).

**Response to Arguments**

13. Applicant's arguments, filed 10/23/2008 have been carefully considered, but are not persuasive.

14. The 102 (a) rejections are withdrawn. All other withdrawn art rejections are withdrawn because they are either cumulative to the remaining rejections and in order to simplify the number of issues.

15. The applied references were supplied by Applicants and have been previously applied.

16. Most of Applicant's arguments are moot in view of the updated rejections applied against the amended claims.

17. Applicant's arguments regarding hydrophones vs geophones are noted. However, Applicants have provided no evidence. Regardless, only claim 26 recites 'hydrophones', which, as noted, is not recited in the specification.

18. Applicants argue (pg. 18, apparently referring to par. 32):

In paragraph 31 of the office action, the Examiner also cites Shallow Water Flow Prediction Using Prestack Waveform Inversion of Conventional 3D Seismic Data and Rock Modelling, 2002 by Mallick et al. (Mallick 2002). This reference is published after the filing date of the present application. Accordingly, this reference is an improper reference.

The reference was used as evidence of admission by Applicants about a prior art reference, and not as a "reference". Par. 32 clearly stated:

32. Note that Mallick et al. (*Shallow water flow prediction using prestack waveform inversion of*

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*conventional 3D seismic data and rock modeling; 2002)*

provides buttressing evidence:

"For prestack inversion, we use the genetic algorithm (GA) based methodology developed by Mallick (1995, 1999) which allows accurate estimates of  $V_p$ ,  $V_s$ , and bulk density as functions of time and depth at the selected locations. The GA prestack inversion is an optimization algorithm that finds a suitable earth model by minimizing the misfit between observed and synthetic data traces. It should be noted that the GA uses an exact wave equation based forward modeling, which allows one to calculate all primary, multiple, and mode-converted reflections."

Applicants have not addressed the merits of the admission and have therefore acquiesced to the position.

### **Conclusion**

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hugh Jones whose telephone number is (571) 272-3781. The examiner can normally be reached on M-Th.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamini Shah can be reached on (571) 272-2279. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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